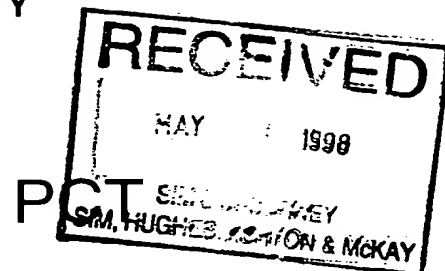


PATENT COOPERATION TREATY

From the
INTERNATIONAL PRELIMINARY EXAMINING AUTHORITY

To:

WARREN, Galloway J.
Sim & McBurney
330 University Avenue
Suite 701, 6th floor
Toronto, Ontario M5G 1R7
CANADA



NOTIFICATION OF TRANSMITTAL OF
THE INTERNATIONAL PRELIMINARY
EXAMINATION REPORT
(PCT Rule 71.1)

Date of mailing
(day/month/year)

22. 05. 98

Applicant's or agent's file reference
7245-17 WJG

IMPORTANT NOTIFICATION

International application No.
PCT/CA97/00212

International filing date (day/month/year)
03/04/1997

Priority date (day/month/year)
03/04/1996

Applicant

CESARONI TECHNOLOGIES INC. et al.

1. The applicant is hereby notified that this International Preliminary Examining Authority transmits herewith the international preliminary examination report and its annexes, if any, established on the international application.
2. A copy of the report and its annexes, if any, is being transmitted to the International Bureau for communication to all the elected Offices.
3. Where required by any of the elected Offices, the International Bureau will prepare an English translation of the report (but not of any annexes) and will transmit such translation to those Offices.

4. REMINDER

The applicant must enter the national phase before each elected Office by performing certain acts (filing translations and paying national fees) within 30 months from the priority date (or later in some Offices) (Article 39(1)) (see also the reminder sent by the International Bureau with Form PCT/IB/301).

Where a translation of the international application must be furnished to an elected Office, that translation must contain a translation of any annexes to the international preliminary examination report. It is the applicant's responsibility to prepare and furnish such translation directly to each elected Office concerned.

For further details on the applicable time limits and requirements of the elected Offices, see Volume II of the PCT Applicant's Guide.

Name and mailing address of the IPEA/

 European Patent Office
D-80298 Munich
Tel. (+49-89) 2399-0, Tx: 523656 epmu d
Fax: (+49-89) 2399-4465

Authorized officer

Vatel, M

Tel. (+49-89) 2399-8225



PCT

INTERNATIONAL SEARCH REPORT

(PCT Article 18 and Rules 43 and 44)

| | | |
|---|---|---|
| Applicant's or agent's file reference 7245-17 WJG | FOR FURTHER ACTION see Notification of Transmittal of International Search Report (Form PCT/ISA/220) as well as, where applicable, item 5 below. | |
| International application No. PCT/CA 97/ 00212 | International filing date(<i>day/month/year</i>) 03/04/1997 | (Earliest) Priority Date (<i>day/month/year</i>) 03/04/1996 |
| Applicant CESARONI TECHNOLOGIES INC. et al. | | |

This International Search Report has been prepared by this International Searching Authority and is transmitted to the applicant according to Article 18. A copy is being transmitted to the International Bureau.

This International Search Report consists of a total of 3 sheets.

☒ It is also accompanied by a copy of each prior art document cited in this report.

1. ☐ Certain claims were found unsearchable (see Box I).

2. ☐ Unity of invention is lacking (see Box II).

3. ☐ The international application contains disclosure of a nucleotide and/or amino acid sequence listing and the international search was carried out on the basis of the sequence listing

☐ filed with the international application.

☐ furnished by the applicant separately from the international application,

☐ but not accompanied by a statement to the effect that it did not include matter going beyond the disclosure in the international application as filed.

☐ Transcribed by this Authority

4. With regard to the title, ☐ the text is approved as submitted by the applicant.

☒ the text has been established by this Authority to read as follows:

LEAD-FREE BULLET.

5. With regard to the abstract,

☒ the text is approved as submitted by the applicant.

☐ the text has been established, according to Rule 38.2(b), by this Authority as it appears in Box III. The applicant may, within one month from the date of mailing of this International Search Report, submit comments to this Authority.

6. The figure of the drawings to be published with the abstract is:

Figure No. 2A ☒ as suggested by the applicant.

☐ None of the figures.

☐ because the applicant failed to suggest a figure.

☐ because this figure better characterizes the invention.

INTERNATIONAL SEARCH REPORT

International Application No

PCT/CA 97/00212

A. CLASSIFICATION OF SUBJECT MATTER
IPC 6 F42B12/74

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 6 F42B

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

| Category * | Citation of document, with indication, where appropriate, of the relevant passages | Relevant to claim No. |
|------------|---|---|
| Y | W0 95 23952 A (EDB SA) 8 September 1995 cited in the application see page 2, line 33 - page 5, line 5; figures | 1-5, 7-10, 16-21, 24-27, 29,31-34 |
| Y | US 5 012 743 A (DENIS) 7 May 1991 cited in the application see column 2, line 18 - column 3, line 3; figures | 1-5, 7-10, 16-21, 24-27, 29,31-34 |
| Y | W0 94 11697 A (PERSSON) 26 May 1994 see the whole document | 2,3,7,20 |
| | --- -/-- | |

☒ Further documents are listed in the continuation of box C.

☒ Patent family members are listed in annex.

* Special categories of cited documents :

- *A* document defining the general state of the art which is not considered to be of particular relevance
- *E* earlier document but published on or after the international filing date
- *L* document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
- *O* document referring to an oral disclosure, use, exhibition or other means
- *P* document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

X document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

Y document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

* & * document member of the same patent family

Date of the actual completion of the international search

23 July 1997

Date of mailing of the international search report

01.08.97

Name and mailing address of the ISA

European Patent Office, P.B. 5818 Patentlaan 2
NL - 2280 HV Rijswijk
Tel. (+31-70) 340-2040, Tx. 31 651 epo nl,
Fax (+31-70) 340-3016

Authorized officer

Triantaphillou, P

INTERNATIONAL SEARCH REPORT

International Application No

PCT/CA 97/00212

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

| Category * | Citation of document, with indication, where appropriate, of the relevant passages | Relevant to claim No. |
|------------|---|-----------------------|
| Y | DE 92 09 598 U (METALLWERK ELISENHÜTTE GMBH) 12 November 1992 see page 5, line 10 - page 8, line 19; figures --- | 1-5,7,9, 19-21 |
| Y | GB 1 175 274 A (IMPERIAL METAL INDUSTRIES) 23 December 1969 see page 1, line 36 - page 3, line 13 --- | 1-5,7,9, 19-21 |
| Y | FR 2 691 156 A (SOCIETE FRANCAISE DE MUNITIONS) 19 November 1993 see page 1, line 36 - page 4, line 10 --- | 2,3,7,20 |
| Y | US 4 503 777 A (YOUNG) 12 March 1985 see column 2, line 53 - column 7, line 5; figures --- | 1-5,7,9, 19-21 |
| Y | US 5 399 187 A (MRAVIC) 21 March 1995 cited in the application see column 3, line 17 - column 8, line 4 --- | 1-5,7,9, 19-21 |
| Y | WO 93 16349 A (SNC INDUSTRIAL TECHNOLOGIES INC) 19 August 1993 see page 10, line 2 - page 19, line 17 ----- | 2,3,7,20 |

INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No

PCT/CA 97/00212

| Patent document cited in search report | Publication date | Patent family member(s) | Publication date |
|---|---------------------|--|--|
| WO 9523952 A | 08-09-95 | BE 1008136 A AU 1750595 A EP 0748434 A | 30-01-96 18-09-95 18-12-96 |
| US 5012743 A | 07-05-91 | BE 1001874 A AU 615359 B AU 4589189 A CN 1043387 A,B EP 0373140 A SG 98694 A | 03-04-90 26-09-91 07-06-90 27-06-90 13-06-90 28-10-94 |
| WO 9411697 A | 26-05-94 | AU 5439394 A SE 9203336 A | 08-06-94 10-05-94 |
| DE 9209598 U | 12-11-92 | EP 0578981 A NO 932497 A | 19-01-94 18-01-94 |
| GB 1175274 A | 23-12-69 | NONE | |
| FR 2691156 A | 19-11-93 | NONE | |
| US 4503777 A | 12-03-85 | NONE | |
| US 5399187 A | 21-03-95 | AU 5739794 A BR 9307891 A CA 2169457 A CZ 9600857 A EP 0720662 A FI 961340 A NO 961186 A WO 9508653 A ZA 9407460 A | 10-04-95 10-09-96 30-03-95 17-07-96 10-07-96 22-03-96 22-03-96 30-03-95 15-05-95 |
| WO 9316349 A | 19-08-93 | US 5237930 A AT 150541 T AU 673155 B AU 3487993 A BR 9305849 A CA 2128696 A DE 69309041 D | 24-08-93 15-04-97 31-10-96 03-09-93 18-02-97 19-08-93 24-04-97 |

INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No

PCT/CA 97/00212

| Patent document cited in search report | Publication date | Patent family member(s) | Publication date |
|---|---------------------|----------------------------|---------------------|
| WO 9316349 A | | DE 69309041 T | 26-06-97 |
| | | EP 0625258 A | 23-11-94 |
| | | JP 7503528 T | 13-04-95 |
| | | NO 942927 A | 08-08-94 |
| ----- | | | |

PCT

NOTIFICATION OF THE RECORDING
OF A CHANGE

(PCT Rule 92bis.1 and
Administrative Instructions, Section 422)

From the INTERNATIONAL BUREAU

To:

GALLOWAY, Warren, J.
Sim & McBurney
6th floor
330 University Avenue
Toronto, Ontario M5G 1R7
CANADA

Date of mailing (day/month/year)

11 February 1998 (11.02.98)

Applicant's or agent's file reference

7245-17 WJG

IMPORTANT NOTIFICATION

International application No.

PCT/CA97/00212

International filing date (day/month/year)

03 April 1997 (03.04.97)

1. The following indications appeared on record concerning:

☒

the applicant

☐

the inventor

☐

the agent

☐

the common representative

Name and Address

CESARONI TECHNOLOGIES INC.
P.O. Box 246
2561 Stouffville Road
Gormley, Ontario L0H 1G0
Canada

State of Nationality

CA

State of Residence

CA

Telephone No.

Facsimile No.

Teleprinter No.

2. The International Bureau hereby notifies the applicant that the following change has been recorded concerning:

☐

the person

☒

the name

☐

the address

☐

the nationality

☐

the residence

Name and Address

CESARONI TECHNOLOGY INC.
P.O. Box 246
2561 Stouffville Road
Gormley, Ontario L0H 1G0
Canada

State of Nationality

CA

State of Residence

CA

Telephone No.

Facsimile No.

Teleprinter No.

3. Further observations, if necessary:

4. A copy of this notification has been sent to:

☒

the receiving Office

☐

the International Searching Authority

☒

the International Preliminary Examining Authority

☐

the designated Offices concerned

☒

the elected Offices concerned

☐

other:

The International Bureau of WIPO
34, chemin des Colombettes
1211 Geneva 20, Switzerland

Facsimile No.: (41-22) 740.14.35

Authorized officer

H. Zhou

Telephone No.: (41-22) 338.83.38

PCT

NOTIFICATION OF ELECTION

(PCT Rule 61.2)

From the INTERNATIONAL BUREAU

To:

United States Patent and Trademark
Office
(Box PCT)
Crystal Plaza 2
Washington, DC 20231
ETATS-UNIS D'AMERIQUE

in its capacity as elected Office

Date of mailing (day/month/year)

06 November 1997 (06.11.97)

International application No.

PCT/CA97/00212

Applicant's or agent's file reference

7245-17 WJG

International filing date (day/month/year)

03 April 1997 (03.04.97)

Priority date (day/month/year)

03 April 1996 (03.04.96)

Applicant

CESARONI, Anthony, J.

1. The designated Office is hereby notified of its election made:



in the demand filed with the International Preliminary Examining Authority on:

24 October 1997 (24.10.97)



in a notice effecting later election filed with the International Bureau on:

2. The election ☒ was



was not

made before the expiration of 19 months from the priority date or, where Rule 32 applies, within the time limit under Rule 32.2(b).

The International Bureau of WIPO
34, chemin des Colombettes
1211 Geneva 20, Switzerland

Facsimile No.: (41-22) 740.14.35

Authorized officer

J. Leitao

Telephone No.: (41-22) 338.83.38

PATENT COOPERATION TREATY

REC'D 25 JUN 1998

WIPO

PCT

PCT

INTERNATIONAL PRELIMINARY EXAMINATION REPORT

(PCT Article 36 and Rule 70)

| | | |
|---|--|--|
| Applicant's or agent's file reference 7245-17 WJG | FOR FURTHER ACTION See Notification of Transmittal of International Preliminary Examination Report (PCT/IPEA/416) | |
| International application No. PCT/CA97/00212 | International filing date (day/month/year) 03/04/1997 | Priority date (day/month/year) 03/04/1996 |
| International Patent Classification (IPC) or national classification and IPC F42B12/74 | | |
| Applicant TECHNOLOGY CESARONI TECHNOLOGIES INC. et al. | | |

1. This international preliminary examination report has been prepared by this International Preliminary Examining Authority and is transmitted to the applicant according to Article 36.



2. This REPORT consists of a total of 4 sheets, including this cover sheet.

- ☒ This report is also accompanied by ANNEXES, i.e., sheets of the description, claims and/or drawings which have been amended and are the basis for this report and/or sheets containing rectifications made before this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions under the PCT).

These annexes consist of a total of 7 sheets.

3. This report contains indications relating to the following items:

- I ☒ Basis of the report
- II ☐ Priority
- III ☐ Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
- IV ☐ Lack of unity of invention
- V ☒ Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
- VI ☐ Certain documents cited
- VII ☒ Certain defects in the international application
- VIII ☐ Certain observations on the international application

| | |
|---|--|
| Date of submission of the demand 24/10/1997 | Date of completion of this report 22.05.98 |
| Name and mailing address of the IPEA/  European Patent Office D-80298 Munich Tel. (+49-89) 2399-0, Tx: 523656 epmu d Fax: (+49-89) 2399-4465 | Authorized officer Wetzel, H Telephone No. (+49-89) 2399-2127  |

**INTERNATIONAL PRELIMINARY
EXAMINATION REPORT**

International application No. PCT/CA97/00212

I. Basis of the report

1. This report has been drawn on the basis of (*substitute sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to the report since they do not contain amendments.*):

Description, pages:

| | | | | |
|----------|---------------------|------------|----------------|------------|
| 1,2,4-17 | as originally filed | | | |
| 3,3a | as received on | 21/04/1998 | with letter of | 16/04/1998 |

Claims, No.:

| | | | | |
|------|----------------|------------|----------------|------------|
| 1-37 | as received on | 21/04/1998 | with letter of | 16/04/1998 |
|------|----------------|------------|----------------|------------|

Drawings, sheets:

| | | | | |
|---------|----------------|------------|----------------|------------|
| 1/3-3/3 | as received on | 24/04/1997 | with letter of | 24/04/1997 |
|---------|----------------|------------|----------------|------------|

2. The amendments have resulted in the cancellation of:

- ☐ the description, pages:
☐ the claims, Nos.:
☐ the drawings, sheets:

3. ☐ This report has been established as if (some of) the amendments had not been made, since they have been considered to go beyond the disclosure as filed (Rule 70.2(c)):

4. Additional observations, if necessary:

**INTERNATIONAL PRELIMINARY
EXAMINATION REPORT**

International application No. PCT/CA97/00212

V. Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. Statement

| | | | |
|-------------------------------|------|--------|------|
| Novelty (N) | Yes: | Claims | 1-37 |
| | No: | Claims | |
| Inventive step (IS) | Yes: | Claims | 1-37 |
| | No: | Claims | |
| Industrial applicability (IA) | Yes: | Claims | 1-37 |
| | No: | Claims | |

2. Citations and explanations

see separate sheet

VII. Certain defects in the international application

The following defects in the form or contents of the international application have been noted:

see separate sheet

**INTERNATIONAL PRELIMINARY
EXAMINATION REPORT - SEPARATE SHEET**

International application No. PCT/CA97/00212

1. Reference is made to the following documents:

D1: WO 95/23952,
D2: US-A-5 012 743,
D3: DE-U-9 209 598 and
D4: US-A-4 503 777.

2. D1 discloses a projectile having a core of polyethylene and iron.

D2 discloses a projectile formed from a casing of copper alloy, steel or similar material and a lower density core e.g. polycarbonate or polyamide.

D3 discloses a projectile formed from a plastic viz. polypropylene homopolymer, and a metal jacket.

D4 discloses a lead bullet manufactured by the pouring of lead.

None of D1-D4 discloses a bullet comprising all the features defined in independent claims 1 (device) and 22 (method).

Therefore, claims 1 and 22 both involve novelty and inventive step.

3. Claims 1 and 22 are not drafted in the two-part form.
4. The opening part of the description is not adapted to the claims .
5. It appears that the claim 1 to some extent attempts to define the subject-matter in terms of the result to be achieved which merely amounts to a statement of the underlying problem.

CLAIMS:

1. A bullet that will retain markings from a firearm barrel when fired from such firearm, comprising:
- 5 a right cylindrical core with opposed ends, one such opposed end having a tapered section integrally connected thereto, said core being formed from a lead-free composition comprising a filler and a polymer selected from amorphous or low crystallinity polymer, said
- 10 composition retaining it's integrity when fired from the firearm, said right cylindrical core having a jacket that is cylindrical and formed from a thermoplastic polymer or copper, said thermoplastic polymer having a softening point above firearm barrel temperatures, the adhesion
- 15 between the jacket and the core being sufficient to retain the integrity of the bullet on firing until impact, said bullet having a weight that is at least 80% that of a comparable bullet for such firearm, said comparable bullet being formed from lead.
- 20
2. The bullet of Claim 2 in which the weight is at least 85% of the comparable lead bullet.
3. The bullet of any one of Claims 1-2 in
- 25 which the jacket and core separate on impact.
4. The bullet of any one of Claims 1-3 in which the mass of the bullet is sufficient to actuate firearm reloading mechanisms.
- 30
5. The bullet of any one of Claims 1-4 in which the tapered section is a truncated cone or truncated parabellum.
- 35
6. The bullet of any one of Claims 1-4 in which the bullet has a tip that is parabolic, rounded or a hollow point.

7. The bullet of any one of Claims 1-6 in which the jacket of the bullet extends over the tapered section attached to one end of the right cylindrical core.

5

8. The bullet of any one of Claims 1-7 in which the other of the opposed ends is a truncated tapered section.

10

9. The bullet of any one of Claims 1-8 in which the polymer of the core is an ionomer.

15

10. The bullet of any one of Claims 1-8 in which the polymer of the core is selected from ethylene/methacrylic acid copolymer ionomers, polyetherester elastomers and polyamides.

20

11. The bullet of any one of Claims 1-8 in which the polymer of the core is an ethylene/methacrylic acid copolymer ionomer.

25

12. The bullet of any one of Claims 1-8 in which the polymer of the core is polyamide.

13. The bullet of Claim 12 in which the polyamide is nylon 11.

30

14. The bullet of any one of Claims 1-13 in which the filler is particles of copper.

15. The bullet of any one of Claims 1-13 in which the filler is selected from the group consisting of tungsten, bismuth, tin and stainless steel.

35

16. The bullet of any one of Claims 1-13 in which the bullet retains markings from the barrel of said firearm.

17. The bullet of any one of Claims 1-16 in which the jacket at the other of the opposed ends is curled inwards towards the tip.

5

18. The bullet of Claim 17 in which the remainder of said end is free of jacket.

19. The bullet of any one of Claims 1-18 in which the jacket is copper.

10

20. The bullet of any one of Claims 1-18 in which the jacket is a thermoplastic polymer.

15

21. A bullet of any one of claims 1-18 in a shell, said bullet being capable of being inserted into a firearm and fired therefrom.

22. A method for the manufacture of a bullet comprising the steps of:

20

(a) inserting a right cylindrical shell having one open end into a mould of an injection moulding apparatus, said shell being formed from a thermoplastic polymer or copper;

25

(b) injecting a composition of a filler and a polymer selected from amorphous or low crystallinity polymer into said shell; and

(c) removing said bullet so formed from the mould.

30

23. The method of Claims 22 in which in step (b), the composition is injected into the right cylindrical shell and the shell is formed into the shape of the bullet.

35

24. The method of Claim 23 in which the injection of the compositions and the forming of the

shell to the shape of the bullet is carried out in a one-step injection moulding process.

25. The method of any one of Claims 22-24 in
5 which the shell is copper.

26. The method of any one of Claims 22-25 in
which the cylindrical shell has preformed tip.

10 27. The method of any one of Claim 22-25 in
which the tip is a hollow point tip, the end of the
cylindrical shell opposed to the open end being formed
into a shape in said mould.

15 28. The method of Claim 27 in which the said
end is formed into the shape of a truncated cone.

20 29. The method of Claim 26 in which, in step
(b), the cylindrical shell at its open end is curled in
step (b) such that said end is curled inwardly towards
the tip.

30. The method of Claim 29 in which the shell
is curled inwardly by more than 90°.

25 31. The method of Claim 29 in which the shell
is curled inwardly by at least 150°.

30 32. The method of Claim 29 in which the shell
is curled inwardly by at least 180°.

33. The method of any one of Claims 22-32 in
which the polymer of the composition is an ionomer.

35 34. The method of any one of Claims 22-32 in
which the polymer of the core is selected from
ethylene/methacrylic acid copolymer ionomers,

polyetherester elastomers and polyamides.

35. The method of any one of Claims 22-32 in
which the polymer of the core is an ethylene/methacrylic
5 acid copolymer ionomer.

36. The method of any one of Claims 22-32 in
which the polymer is nylon 11.

10 37. The method of any one of Claim 22-36 in
which the filler is particles of copper.

PATENT COOPERATION TREATY

PCT

INTERNATIONAL PRELIMINARY EXAMINATION REPORT

(PCT Article 36 and Rule 70)

| | | | |
|---|--|--|--|
| Applicant's or agent's file reference 7245-17 WJG | FOR FURTHER ACTION | | See Notification of Transmittal of International Preliminary Examination Report (PCT/IPEA/416) |
| International application No. PCT/CA97/00212 | International filing date (day/month/year) 03/04/1997 | Priority date (day/month/year) 03/04/1996 | |
| International Patent Classification (IPC) or national classification and IPC F42B12/74 | | | |
| Applicant CESARONI TECHNOLOGIES INC. et al. | | | |

1. This international preliminary examination report has been prepared by this International Preliminary Examining Authority and is transmitted to the applicant according to Article 36.



2. This REPORT consists of a total of 4 sheets, including this cover sheet.

- ☒ This report is also accompanied by ANNEXES, i.e., sheets of the description, claims and/or drawings which have been amended and are the basis for this report and/or sheets containing rectifications made before this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions under the PCT).

These annexes consist of a total of 7 sheets.

3. This report contains indications relating to the following items:

- I ☒ Basis of the report
- II ☐ Priority
- III ☐ Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
- IV ☐ Lack of unity of invention
- V ☒ Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
- VI ☐ Certain documents cited
- VII ☒ Certain defects in the international application
- VIII ☐ Certain observations on the international application

| | |
|---|---|
| Date of submission of the demand 24/10/1997 | Date of completion of this report 22.05.98 |
| Name and mailing address of the IPEA/  European Patent Office D-80298 Munich Tel. (+49-89) 2399-0, Tx: 523656 epmu d Fax: (+49-89) 2399-4465 | Authorized officer Wetzel, H Telephone No. (+49-89) 2399-2127  |

INTERNATIONAL PRELIMINARY EXAMINATION REPORT

International application No. PCT/CA97/00212

I. Basis of the report

1. This report has been drawn on the basis of (*substitute sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to the report since they do not contain amendments.*):

Description, pages:

| | | | | |
|----------|---------------------|------------|----------------|------------|
| 1,2,4-17 | as originally filed | | | |
| 3,3a | as received on | 21/04/1998 | with letter of | 16/04/1998 |

Claims, No.:

| | | | | |
|------|----------------|------------|----------------|------------|
| 1-37 | as received on | 21/04/1998 | with letter of | 16/04/1998 |
|------|----------------|------------|----------------|------------|

Drawings, sheets:

| | | | | |
|---------|----------------|------------|----------------|------------|
| 1/3-3/3 | as received on | 24/04/1997 | with letter of | 24/04/1997 |
|---------|----------------|------------|----------------|------------|

2. The amendments have resulted in the cancellation of:

- ☐ the description, pages:
- ☐ the claims, Nos.:
- ☐ the drawings, sheets:

3. ☐ This report has been established as if (some of) the amendments had not been made, since they have been considered to go beyond the disclosure as filed (Rule 70.2(c)):

4. Additional observations, if necessary:

INTERNATIONAL PRELIMINARY EXAMINATION REPORT

International application No. PCT/CA97/00212

V. Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. Statement

| | | | |
|-------------------------------|------|--------|------|
| Novelty (N) | Yes: | Claims | 1-37 |
| | No: | Claims | |
| Inventive step (IS) | Yes: | Claims | 1-37 |
| | No: | Claims | |
| Industrial applicability (IA) | Yes: | Claims | 1-37 |
| | No: | Claims | |

2. Citations and explanations

see separate sheet

VII. Certain defects in the international application

The following defects in the form or contents of the international application have been noted:

see separate sheet

**INTERNATIONAL PRELIMINARY
EXAMINATION REPORT - SEPARATE SHEET**

International application No. PCT/CA97/00212

1. Reference is made to the following documents:

D1: WO 95/23952,
D2: US-A-5 012 743,
D3: DE-U-9 209 598 and
D4: US-A-4 503 777.

2. D1 discloses a projectile having a core of polyethylene and iron.

D2 discloses a projectile formed from a casing of copper alloy, steel or similar material and a lower density core e.g. polycarbonate or polyamide.

D3 discloses a projectile formed from a plastic viz. polypropylene homopolymer, and a metal jacket.

D4 discloses a lead bullet manufactured by the pouring of lead.

None of D1-D4 discloses a bullet comprising all the features defined in independent claims 1 (device) and 22 (method).

Therefore, claims 1 and 22 both involve novelty and inventive step.

3. Claims 1 and 22 are not drafted in the two-part form.

4. The opening part of the description is not adapted to the claims .

5. It appears that the claim 1 to some extent attempts to define the subject-matter in terms of the result to be achieved which merely amounts to a statement of the underlying problem.

1654698

to create a pressure within the barrel during the firing of the bullet that is sufficient to actuate the mechanisms for ejection of the shell and insertion of the next bullet into the firing chamber.

5 After the firing of a bullet in a firearm having an automatic reloading mechanism, the next round is inserted into the firing chamber pending the next firing of a further bullet. In rapid-firing firearms, the barrel of the firearm may become very hot, depending
10 in particular on the number of bullets fired in a sequence, and consequently the bullet loaded into the firing chamber may become hot. Thus, bullets intended for rapid-firing firearms must have properties that will withstand the temperatures to which the bullet might be
15 subjected in the firing chamber, without softening of any casing, fragmentation of a non-frangible bullet or other deleterious effects that might cause malfunctioning of the firearm, poor trajectory of the bullet or other problems.

20 Lead-free bullets are known. For instance, U.S. 5 399 187 discloses a bullet formed from tungsten, or an alloy of tungsten, and phenol formaldehyde or polymethylmethacrylate polymers. U.S. 5 012 743 discloses a light weight elongated projectile formed from
25 a casing of copper alloy, steel or similar material and a lower density core e.g. polycarbonate or polyamide. WO 95/23952 discloses a projectile having a core of polyethylene and iron. Projectiles formed from bismuth alloys are disclosed in WO 92/08097 and WO 95/08748.

30 Bullets that are free of lead are strongly preferred both for environmental and health reasons, and in many instances are required by governmental regulations. Thus, there is a need for lead-free
35 bullets, and especially for such bullets that will retain the signature of a barrel on firing. Such bullets have now been found.

to create a pressure within the barrel during the firing of the bullet that is sufficient to actuate the mechanisms for ejection of the shell and insertion of the next bullet into the firing chamber.

After the firing of a bullet in a firearm having an automatic reloading mechanism, the next round is inserted into the firing chamber pending the next firing of a further bullet. In rapid-firing firearms, the barrel of the firearm may become very hot, depending in particular on the number of bullets fired in a sequence, and consequently the bullet loaded into the firing chamber may become hot. Thus, bullets intended for rapid-firing firearms must have properties that will withstand the temperatures to which the bullet might be subjected in the firing chamber, without softening of any casing, fragmentation of a non-frangible bullet or other deleterious effects that might cause malfunctioning of the firearm, poor trajectory of the bullet or other problems.

Lead-free bullets are known. For instance, U.S. 5 399 187 discloses a bullet formed from tungsten, or an alloy of tungsten, and phenol formaldehyde or polymethylmethacrylate polymers. U.S. 5 012 743 discloses a light weight elongated projectile formed from a casing of copper alloy, steel or similar material and a lower density core e.g. polycarbonate or polyamide. WO 95/23952 discloses a projectile having a core of polyethylene and iron. DE-U-9209598 discloses a bullet formed from a plastic viz. polypropylene homopolymer, and a metal jacket. U.S. 4 503 777 discloses a lead bullet manufactured by the pouring of lead. Projectiles formed

from bismuth alloys are disclosed in WO 92/08097 and WO 95/08748.

Bullets that are free of lead are strongly preferred both for environmental and health reasons, and in many instances are required by governmental regulations. Thus, there is a need for lead-free bullets, and especially for such bullets that will retain the signature of a barrel on firing. Such bullets have now been found.

CLAIMS:

1. A bullet that will retain markings from a firearm barrel when fired from such firearm, comprising:
5 a right cylindrical core with opposed ends, one such opposed end having a tapered section integrally connected thereto, said core being formed from a lead-free composition comprising a polymer selected from amorphous or low crystallinity polymer, said composition retaining
10 it's integrity when fired from the firearm, said right cylindrical core having a jacket that is cylindrical and formed from a thermoplastic polymer or copper, said thermoplastic polymer having a softening point above firearm barrel temperatures.

15 2. The bullet of Claim 1 in which the weight thereof is at least 80% that of a comparable bullet for such firearm, said comparable bullet being formed from lead.

20 3. The bullet of Claim 2 in which the weight is at least 85% of the comparable lead bullet.

25 4. The bullet of Claim 1 in which the lead-free composition contains a filler.

30 5. The bullet of Claim 1 or Claim 4 in which the adhesion between the jacket and the core is sufficient to retain the integrity of the bullet on firing until impact.

6. The bullet of any one of Claims 1-5 in which the jacket and core separate on impact.

35 7. The bullet of any one of Claims 1-6 in which the mass of the bullet is sufficient to actuate firearm reloading mechanisms.

8. The bullet of any one of Claims 1-7 in which the tapered section is a truncated cone or truncated parabolium.

9. The bullet of any one of Claims 1-7 in which the bullet has a tip that is parabolic, rounded or a hollow point.

10. The bullet of any one of Claims 1-9 in which the jacket of the bullet extends over the tapered section attached to one end of the right cylindrical core.

11. The bullet of any one of Claims 1-10 in which the other of the opposed ends is a truncated tapered section.

12. The bullet of any one of Claims 1-11 in which the polymer of the core is selected from ethylene/methacrylic acid copolymer ionomers, polyetherester elastomers and polyamides.

13. The bullet of any one of Claims 1-11 in which the polymer of the core is an ethylene/methacrylic acid copolymer ionomer.

14. The bullet of any one of Claims 1-11 in which the polymer of the core is polyamide.

15. The bullet of Claim 14 in which the polyamide is nylon 11.

16. The bullet of any one of Claims 1-15 in which the bullet retains markings from the barrel of said firearm.

17. The bullet of any one of Claims 1-16 in which the jacket at the other of the opposed ends is curled inwards towards the tip.

5

18. The bullet of Claim 17 in which the remainder of said end is free of jacket.

10

19. A bullet in a shell, said bullet comprising a right cylindrical core with opposed ends, one such opposed end having a tapered section integrally connected thereto, said core being formed from a lead-free composition comprising a polymer selected from amorphous or low crystallinity polymer, said composition retaining it's integrity when fired from the firearm, said right cylindrical core having a jacket that is cylindrical and formed from a thermoplastic polymer or copper, said thermoplastic polymer having a softening point above firearm barrel temperatures, said bullet being capable of being inserted into a firearm and fired therefrom.

20

20. The bullet of Claim 19 in which the weight thereof is at least 80% that of a comparable bullet for such firearm, said comparable bullet being formed from lead.

25

21. The bullet of Claim 19 or Claim 20 in which the lead-free composition contains a filler.

30

22. The bullet of any one of Claims 19-21 in which the polymer of the core is selected from ethylene/methacrylic acid copolymer ionomers, polyetherester elastomers and polyamides.

35

23. The bullet of any one of Claims 19-21 in which the polymer of the core is an ethylene/methacrylic

acid copolymer ionomer.

24. The bullet of any one of Claims 1-23 in which the jacket at the other of the opposed ends is
5 curled inwards towards the tip, said jacket being curled inwardly by more than 90°.

25. The bullet of Claim 24 in which the jacket is curled inwardly by more than 150°.
10

26. The bullet of Claim 24 in which the jacket is curled inwardly by more than 180°.

27. A method for the manufacture of a bullet
15 comprising the steps of:

(a) inserting a right cylindrical shell having one open end into a mould of an injection moulding apparatus, said shell being formed from a thermoplastic polymer or copper;

20 (b) injecting a composition selected from amorphous or low crystallinity polymer into said shell; and

(c) removing said bullet so formed from the mould.
25

28. The method of Claim 27 in which the cylindrical shell has preformed tip.

29. The method of Claim 27 in which the tip is
30 a hollow point tip, the end of the cylindrical shell opposed to the open end being formed into a shape in said mould.

30. The method of Claim 29 in which the said
35 end is formed into the shape of a truncated cone.

31. The method of Claim 28 in which, in step (b), the cylindrical shell at its open end is curled in step (b) such that said end is curled inwardly towards the tip.

5

32. The method of Claim 31 in which the shell is curled inwardly by more than 90°.

10

33. The method of Claim 31 in which the shell is curled inwardly by at least 150°.

34. The method of Claim 31 in which the shell is curled inwardly by at least 180°.

15

35. The method of any one of Claims 24-34 in which the polymer of the core is selected from ethylene/methacrylic acid copolymer ionomers, polyetherester elastomers and polyamides.

20

36. The method of any one of Claims 24-34 in which the polymer of the core is an ethylene/methacrylic acid copolymer ionomer.

25

37. The method of any one of Claims 24-34 in which the polymer is nylon 11.